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<110> E. I. du Pont de Nemours and Company

<120> Membrane-Bound Desaturases

<130> BB1264

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<150> 60/110,784

<151> 1998-December-03

<160> 17

<170> Microsoft Office 97

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<211> 1471

<212> DNA

<213> Picramnia pentandra

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<222> (1402)

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<211> 448

<212> PRT

<213> Picramnia pentandra

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Ile Ser Lys Trp Thr Lys Glu His Pro Gly Gly Glu Leu Pro Leu Leu  
35 40 45  
Ser Phe Ala Gly Gln Asp Val Thr Asp Ala Phe Ile Ala Tyr His Pro  
50 55 60  
Gly Thr Ala Trp Gln Tyr Leu Asp Arg Phe Phe Thr Gly Tyr Tyr Val  
65 70 75 80  
Gln Asp Tyr Ser Val Ser Glu Met Ser Lys Asp Tyr Arg Arg Leu Val  
85 90 95  
Ser Glu Phe Ser Lys Met Gly Leu Phe Lys Thr Pro Gly Lys Gly Val  
100 105 110  
Tyr Cys Ser Ile Phe Phe Val Ser Val Leu Phe Ala Leu Ser Val Tyr  
115 120 125  
Gly Val Leu Tyr Cys Lys Ser Thr Trp Ala His Leu Cys Ser Gly Leu  
130 135 140  
Leu Met Gly Met Leu Trp Leu Gln Ser Gly Trp Val Gly His Asp Ser  
145 150 155 160  
Cys His Tyr Gln Val Met Pro Asn Arg Lys Leu Asn Arg Leu Phe Gln  
165 170 175  
Ile Ile Ala Gly Asn Val Ile Ala Gly Val Ser Val Ala Trp Trp Lys  
180 185 190  
Leu Asp His Asn Thr His His Phe Ala Cys Asn Ser Ala Asn Leu Asp  
195 200 205  
Pro Asp Ile Gln His Leu Pro Ile Ile Ala Ile Ser Pro Lys Phe Phe  
210 215 220  
Asn Ser Leu Thr Ser Tyr Tyr His Asn Cys Lys Met Thr Tyr Asp Arg  
225 230 235 240  
Ala Ala Arg Phe Phe Val Ser Phe Gln His Trp Thr Phe Tyr Pro Ala  
245 250 255  
Leu Leu Ser Val Arg Leu Tyr Leu Phe Ile Leu Ser Phe Lys Val Val  
260 265 270  
Phe Ser Asn Asn Lys Arg Val Tyr Lys Arg Ser Gln Glu Ile Leu Gly  
275 280 285  
Tyr Ala Ala Phe Leu Thr Trp Tyr Ser Leu Leu Leu Ser Arg Leu Pro  
290 295 300  
Asn Trp Pro Glu Arg Val Met Tyr Phe Thr Ser Cys Leu Ala Val Ala  
305 310 315 320

Gly Phe Gln His Trp Gln Phe Ser Leu Asn His Phe Ala Ser Asn Val  
 325 330 335  
 Tyr Thr Gly Leu Pro Ser Gly Asn Asp Trp Phe His Gln Gln Thr Lys  
 340 345 350  
 Gly Thr Leu Asn Ile Thr Ala Ser Ala Trp Trp Asp Trp Phe His Gly  
 355 360 365  
 Gly Leu His Phe Gln Ile Glu His His Leu Phe Pro Arg Met Pro Lys  
 370 375 380  
 Cys His Phe Arg Lys Ile Ser Pro Ile Val Asn Lys Leu Cys Gln Lys  
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 His Asn Leu Ser Tyr Glu Thr Ala Thr Met Trp Glu Ala Asn Lys Met  
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 <212> DNA  
 <213> Zea mays

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 <213> Zea mays

<400> 4

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 35 40 45  
 Thr Pro Trp Leu Pro His His Pro Gly Gly Asp Leu Pro Leu Leu Thr  
 50 55 60  
 Leu Ala Gly Gln Asp Ala Thr Asp Ala Phe Ala Ala Tyr His Pro Pro  
 65 70 75 80  
 Ser Ala Arg Pro Leu Leu Arg Arg Phe Phe Val Gly Arg Leu Ser Asp  
 85 90 95  
 Tyr Ala Val Ser Pro Ala Ser Ala Asp Tyr Arg Arg Leu Leu Ala Gln  
 100 105 110  
 Leu Ser Ser Ala Gly Leu Phe Glu Arg Val Gly Pro Thr Pro Lys Val  
 115 120 125  
 Gln Leu Val Leu Met Ala Val Leu Phe Tyr Ala Ala Leu Tyr Leu Val  
 130 135 140  
 Leu Ala Cys Ala Ser Ala Trp Ala His Leu Leu Ala Gly Gly Leu Ile  
 145 150 155 160  
 Gly Phe Val Trp Ile Gln Ser Gly Trp Met Gly His Asp Ser Gly His  
 165 170 175  
 His Arg Ile Thr Gly His Pro Val Leu Asp Arg Val Val Gln Val Leu  
 180 185 190  
 Ser Gly Asn Cys Leu Thr Gly Leu Ser Ile Ala Trp Trp Lys Cys Asn  
 195 200 205  
 His Asn Thr His His Ile Ala Cys Asn Ser Leu Asp His Asp Pro Asp  
 210 215 220  
 Leu Gln His Met Pro Leu Phe Ala Val Ser Pro Lys Leu Phe Gly Asn  
 225 230 235 240  
 Ile Trp Ser Tyr Phe Tyr Gln Arg Thr Leu Ala Phe Asp Ala Ala Ser  
 245 250 255  
 Lys Phe Phe Ile Ser Tyr Gln His Trp Thr Phe Tyr Pro Val Met Cys  
 260 265 270

Ile Ala Arg Ile Asn Leu Leu Ala Gln Ser Ala Leu Phe Val Leu Thr  
 275 280 285  
 Glu Lys Arg Val Pro Gln Arg Leu Leu Glu Ile Ala Gly Val Ala Thr  
 290 295 300  
 Phe Trp Ala Trp Tyr Pro Leu Leu Val Ala Ser Leu Pro Asn Trp Trp  
 305 310 315 320  
 Glu Arg Val Ala Phe Val Leu Phe Ser Phe Thr Ile Cys Gly Ile Gln  
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 His Val Gln Phe Cys Leu Asn His Phe Ser Ser Asp Val Tyr Val Gly  
 340 345 350  
 Pro Pro Lys Gly Asn Asp Trp Phe Glu Lys Gln Thr Ala Gly Thr Leu  
 355 360 365  
 Asp Ile Leu Cys Ser Pro Trp Met Asp Trp Phe His Gly Gly Leu Gln  
 370 375 380  
 Phe Gln Ile Glu His His Leu Phe Pro Arg Leu Pro Arg Cys His Leu  
 385 390 395 400  
 Arg Lys Val Ala Pro Ala Val Arg Asp Leu Cys Lys Lys His Gly Leu  
 405 410 415  
 Thr Tyr Ser Ala Ala Thr Phe Trp Gly Ala Asn Val Leu Thr Trp Lys  
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 Thr Leu Arg Ala Ala Ala Leu Gln Ala Arg Thr Ala Thr Ser Gly Gly  
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 35 40 45  
 Ile Leu Thr Leu Phe Pro Leu Ser Val Cys Gly Val Leu Phe Ser Asp  
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 Ser Thr Phe Val His Val Leu Ser Ala Ala Leu Ile Gly Phe Leu Trp  
 65 70 75 80  
 Ile Gln Ser Gly Trp Ile Gly His Asp Ser Gly His Tyr Asn Val Met  
 85 90 95  
 Leu Ser Arg Arg Leu Asn Arg Ala Ile Gln Ile Leu Ser Gly Asn Ile  
 100 105 110  
 Leu Ala Gly Ile Ser Ile Gly Trp Trp Lys Trp Asn His Asn Ala His  
 115 120 125  
 His Ile Ala Cys Asn Ser Leu Asp Tyr Asp Pro Asp Leu Gln His Met  
 130 135 140

Pro Val Phe Ala Val Ser Ser Arg Phe Phe Asn Ser Ile Thr Ser His  
145 150 155 160

Xaa Tyr Gly Arg Lys Xaa Glu Phe Asp Xaa Ile Ala Xaa Phe Leu Ile  
165 170 175

Cys Tyr Gln His Phe Thr Phe Tyr Pro Val Met Cys Val Ala Arg Val  
180 185 190

Asn Leu Tyr Leu Gln Thr Ile Leu Leu Leu Phe Ser Arg Xaa Lys Val  
195 200 205

Gln Asp Arg Ala Leu Asn Ile Met Gly Ile Leu Val Phe Trp Thr Trp  
210 215 220

Phe Leu Phe Leu Leu Ala Leu Leu Phe Val Pro Ile Gln His Ile Gln  
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<210> 7  
<211> 1934  
<212> DNA  
<213> Glycine max

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aaaaaaaaaa aaaa 1934



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<212> PRT  
<213> Glycine max

<400> 8

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Val Tyr Asn Val Ser Asp Trp Val Lys Glu His Pro Gly Gly Asp Val  
35 40 45  
Pro Ile Ser Asn Leu Ala Gly Gln Asp Val Thr Asp Ala Phe Ile Ala  
50 55 60  
Tyr His Pro Gly Thr Ala Trp Ser His Leu Glu Lys Phe Phe Thr Gly  
65 70 75 80  
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85 90 95  
Lys Leu Ala Ser Glu Phe Ser Lys Leu Gly Leu Phe Asp Thr Lys Gly  
100 105 110  
His Val Thr Ser Cys Thr Leu Ala Ser Val Ala Val Met Phe Leu Ile  
115 120 125  
Val Leu Tyr Gly Val Leu Arg Cys Thr Ser Val Trp Ala His Leu Gly  
130 135 140  
Ser Gly Met Leu Leu Gly Leu Leu Trp Met Gln Ser Ala Tyr Val Gly  
145 150 155 160  
His Asp Ser Gly His Tyr Val Val Met Thr Thr Asn Gly Phe Asn Lys  
165 170 175  
Val Ala Gln Ile Leu Ser Gly Asn Cys Leu Thr Gly Ile Ser Ile Ala  
180 185 190  
Trp Trp Lys Trp Thr His Asn Ala His His Ile Ala Cys Asn Ser Leu  
195 200 205  
Asp His Asp Pro Asp Leu Gln His Met Pro Val Phe Ala Val Ser Ser  
210 215 220  
Arg Phe Phe Asn Ser Ile Thr Ser His Phe Tyr Gly Arg Lys Leu Glu  
225 230 235 240  
Phe Asp Phe Ile Ala Arg Phe Leu Ile Cys Tyr Gln His Phe Thr Phe  
245 250 255  
Tyr Pro Val Met Cys Val Ala Arg Val Asn Leu Tyr Leu Gln Thr Ile  
260 265 270  
Leu Leu Leu Phe Ser Arg Arg Lys Val Gln Asp Arg Ala Leu Asn Ile  
275 280 285

Met Gly Ile Leu Val Phe Trp Thr Trp Phe Pro Leu Leu Val Ser Cys  
 290 295 300

Leu Pro Asn Trp Pro Glu Arg Val Met Phe Val Leu Ala Ser Phe Ala  
 305 310 315 320

Val Cys Ser Ile Gln His Ile Gln Phe Cys Leu Asn His Phe Ala Ala  
 325 330 335

Asn Val Tyr Val Gly Pro Pro Ser Gly Asn Asp Trp Phe Glu Lys Gln  
 340 345 350

Thr Ser Gly Thr Leu Asp Ile Ser Cys Ala Ser Ser Met Asp Trp Phe  
 355 360 365

Phe Gly Gly Leu Gln Phe Gln Leu Glu His His Leu Phe Pro Arg Leu  
 370 375 380

Pro Arg Cys Gln Leu Arg Lys Ile Ser Pro Leu Val Ser Asp Leu Cys  
 385 390 395 400

Lys Lys His Asn Leu Pro Tyr Arg Ser Leu Ser Phe Trp Glu Ala Asn  
 405 410 415

Gln Trp Thr Ile Arg Thr Leu Arg Thr Ala Ala Leu Gln Ala Arg Asp  
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Leu Thr Asn Pro Ala Pro Lys Asn Leu Leu Trp Glu Ala Val Asn Thr  
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His Gly  
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<210> 9  
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 gccagcaagg acgccgccga cgtccgcatg atctccacca aggagctgca ggcgcacgct 240  
 gccgcgacg acctctggat ctccatctcc ggggacgtct acgacgtcac gccgtggctg 300  
 cgccaccacc cgggcggcga ggtcccgtc atcaccctcg ccggccagga cgccaccgac 360  
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 cgctctccg actacaccgt cccccccgcc tccgcccgaet tccgcccgtt cctcgcgcag 480  
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 gactccggcc accaccaa at caccaggcac cccgcgtca accgctcct gcagggtggtc 720  
 tccgggaact gcctcaccgg octcggcatg gcttgggtga agttcaacca caacacacac 780  
 cacatctcct gcaacagcct cgaccatgac ccggacctcc agcacttgc gctcttcgcg 840  
 gttccacca agctcttcaa caacctttgg tccgtctgct acgagcgcac cttggcggtt 900  
 gatgccatat ccaagttctt cgtcagctac cagcactgga cattctaccc ggtgatggga 960  
 tttgcaagga taaatcttct tgtgcagtca atcgtgttcc tgatcacgca aaagaaggtg 1020  
 cggcagcgtt ggctggagat cgcggaggtt gcagcgttct gggtttggtta ccccttgctg 1080  
 gtctcttgcc tgccgaattg gtgggagagg gttgcttttg tgettgaag ctttgtgatc 1140  
 acggggattc agcatgttca gttctgcctg aaccacttct catccgctgt gtatggttggg 1200

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ccaccaaaagg ggaacgactg gtttgagagg caaacagcgg gcacacttga tatcaagtgc 1260
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cctcgcctgc ctgcctgcca ctataggatg gtcgcgccga ttgtgcgtga cctttgcaag 1380
aagcatgggc tgtcttatgg tgccgccaca ttctgggagg caaatgtaat gacatggaag 1440
acgctaaggg ctgcagcatt gcaggccagg gaagccacta ctggagctgc tccaaagaat 1500
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attgtaagcg tcgagccttg cgtgcatgca gttatctgat tgcttctcga ttgcgtagag 1620
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gatggtttgt agcgtgtata tcctgctgct atggcagctt gaactgcatt ttgggaacat 1920
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<210> 10
<211> 469
<212> PRT
<213> Triticum aestivum

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<400> 10
Met Ala Arg Thr Gly Leu Ala Asp Ala Thr Ala Pro Glu Ala Asp Ala
  1          5          10          15
Met Pro Ala Ala Ser Lys Asp Ala Ala Asp Val Arg Met Ile Ser Thr
          20          25          30
Lys Glu Leu Gln Ala His Ala Ala Asp Asp Leu Trp Ile Ser Ile
          35          40          45
Ser Gly Asp Val Tyr Asp Val Thr Pro Trp Leu Arg His His Pro Gly
  50          55          60
Gly Glu Val Pro Leu Ile Thr Leu Ala Gly Gln Asp Ala Thr Asp Ala
  65          70          75          80
Phe Met Ala Tyr His Pro Pro Ser Val Arg Pro Leu Leu Arg Arg Phe
          85          90          95
Phe Val Gly Arg Leu Ser Asp Tyr Thr Val Pro Pro Ala Ser Ala Asp
          100          105          110
Phe Arg Arg Leu Leu Ala Gln Leu Ser Ser Ala Gly Leu Phe Glu Arg
          115          120          125
Val Gly His Thr Pro Lys Phe Leu Leu Val Ala Met Ser Val Leu Phe
          130          135          140
Cys Ile Ala Leu Tyr Cys Val Leu Ala Cys Ser Ser Thr Gly Ala His
          145          150          155          160
Met Phe Ala Gly Gly Leu Ile Gly Phe Ile Trp Ile Gln Ser Gly Trp
          165          170          175
Ile Gly His Asp Ser Gly His His Gln Ile Thr Arg His Pro Ala Leu
          180          185          190
Asn Arg Leu Leu Gln Val Val Ser Gly Asn Cys Leu Thr Gly Leu Gly
          195          200          205

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Ile Ala Trp Trp Lys Phe Asn His Asn Thr His His Ile Ser Cys Asn  
 210 215 220  
 Ser Leu Asp His Asp Pro Asp Leu Gln His Leu Pro Leu Phe Ala Val  
 225 230 235 240  
 Ser Thr Lys Leu Phe Asn Asn Leu Trp Ser Val Cys Tyr Glu Arg Thr  
 245 250 255  
 Leu Ala Phe Asp Ala Ile Ser Lys Phe Phe Val Ser Tyr Gln His Trp  
 260 265 270  
 Thr Phe Tyr Pro Val Met Gly Phe Ala Arg Ile Asn Leu Leu Val Gln  
 275 280 285  
 Ser Ile Val Phe Leu Ile Thr Gln Lys Lys Val Arg Gln Arg Trp Leu  
 290 295 300  
 Glu Ile Ala Gly Val Ala Ala Phe Trp Val Trp Tyr Pro Leu Leu Val  
 305 310 315 320  
 Ser Cys Leu Pro Asn Trp Trp Glu Arg Val Ala Phe Val Leu Ala Ser  
 325 330 335  
 Phe Val Ile Thr Gly Ile Gln His Val Gln Phe Cys Leu Asn His Phe  
 340 345 350  
 Ser Ser Ala Val Tyr Val Gly Pro Pro Lys Gly Asn Asp Trp Phe Glu  
 355 360 365  
 Arg Gln Thr Ala Gly Thr Leu Asp Ile Lys Cys Ser Pro Trp Met Asp  
 370 375 380  
 Trp Phe His Gly Gly Leu Gln Phe Gln Val Glu His His Leu Phe Pro  
 385 390 395 400  
 Arg Leu Pro Arg Cys His Tyr Arg Met Val Ala Pro Ile Val Arg Asp  
 405 410 415  
 Leu Cys Lys Lys His Gly Leu Ser Tyr Gly Ala Ala Thr Phe Trp Glu  
 420 425 430  
 Ala Asn Val Met Thr Trp Lys Thr Leu Arg Ala Ala Ala Leu Gln Ala  
 435 440 445  
 Arg Glu Ala Thr Thr Gly Ala Ala Pro Lys Asn Leu Val Trp Glu Ala  
 450 455 460

Leu Asn Thr His Gly  
 465

<210> 11  
 <211> 448  
 <212> PRT  
 <213> Borago officinalis

<400> 11  
 Met Ala Ala Gln Ile Lys Lys Tyr Ile Thr Ser Asp Glu Leu Lys Asn  
 1 5 10 15

His Asp Lys Pro Gly Asp Leu Trp Ile Ser Ile Gln Gly Lys Ala Tyr  
 20 25 30  
 Asp Val Ser Asp Trp Val Lys Asp His Pro Gly Gly Ser Phe Pro Leu  
 35 40 45  
 Lys Ser Leu Ala Gly Gln Glu Val Thr Asp Ala Phe Val Ala Phe His  
 50 55 60  
 Pro Ala Ser Thr Trp Lys Asn Leu Asp Lys Phe Phe Thr Gly Tyr Tyr  
 65 70 75 80  
 Leu Lys Asp Tyr Ser Val Ser Glu Val Ser Lys Asp Tyr Arg Lys Leu  
 85 90 95  
 Val Phe Glu Phe Ser Lys Met Gly Leu Tyr Asp Lys Lys Gly His Ile  
 100 105 110  
 Met Phe Ala Thr Leu Cys Phe Ile Ala Met Leu Phe Ala Met Ser Val  
 115 120 125  
 Tyr Gly Val Leu Phe Cys Glu Gly Val Leu Val His Leu Phe Ser Gly  
 130 135 140  
 Cys Leu Met Gly Phe Leu Trp Ile Gln Ser Gly Trp Ile Gly His Asp  
 145 150 155 160  
 Ala Gly His Tyr Met Val Val Ser Asp Ser Arg Leu Asn Lys Phe Met  
 165 170 175  
 Gly Ile Phe Ala Ala Asn Cys Leu Ser Gly Ile Ser Ile Gly Trp Trp  
 180 185 190  
 Lys Trp Asn His Asn Ala His His Ile Ala Cys Asn Ser Leu Glu Tyr  
 195 200 205  
 Asp Pro Asp Leu Gln Tyr Ile Pro Phe Leu Val Val Ser Ser Lys Phe  
 210 215 220  
 Phe Gly Ser Leu Thr Ser His Phe Tyr Glu Lys Arg Leu Thr Phe Asp  
 225 230 235 240  
 Ser Leu Ser Arg Phe Phe Val Ser Tyr Gln His Trp Thr Phe Tyr Pro  
 245 250 255  
 Ile Met Cys Ala Ala Arg Leu Asn Met Tyr Val Gln Ser Leu Ile Met  
 260 265 270  
 Leu Leu Thr Lys Arg Asn Val Ser Tyr Arg Ala His Glu Leu Leu Gly  
 275 280 285  
 Cys Leu Val Phe Ser Ile Trp Tyr Pro Leu Leu Val Ser Cys Leu Pro  
 290 295 300  
 Asn Trp Gly Glu Arg Ile Met Phe Val Ile Ala Ser Leu Ser Val Thr  
 305 310 315 320  
 Gly Met Gln Gln Val Gln Phe Ser Leu Asn His Phe Ser Ser Ser Val  
 325 330 335

Tyr Val Gly Lys Pro Lys Gly Asn Asn Trp Phe Glu Lys Gln Thr Asp  
 340 345 350  
 Gly Thr Leu Asp Ile Ser Cys Pro Pro Trp Met Asp Trp Phe His Gly  
 355 360 365  
 Gly Leu Gln Phe Gln Ile Glu His His Leu Phe Pro Lys Met Pro Arg  
 370 375 380  
 Cys Asn Leu Arg Lys Ile Ser Pro Tyr Val Ile Glu Leu Cys Lys Lys  
 385 390 395 400  
 His Asn Leu Pro Tyr Asn Tyr Ala Ser Phe Ser Lys Ala Asn Glu Met  
 405 410 415  
 Thr Leu Arg Thr Leu Arg Asn Thr Ala Leu Gln Ala Arg Asp Ile Thr  
 420 425 430  
 Lys Pro Leu Pro Lys Asn Leu Val Trp Glu Ala Leu His Thr His Gly  
 435 440 445

<210> 12  
 <211> 469  
 <212> PRT  
 <213> Triticum aestivum

<400> 12  
 Met Ala Arg Thr Gly Leu Ala Asp Ala Thr Ala Pro Glu Ala Asp Ala  
 1 5 10 15  
 Met Pro Ala Ala Ser Lys Asp Ala Ala Asp Val Arg Met Ile Ser Thr  
 20 25 30  
 Lys Glu Leu Gln Ala His Ala Ala Ala Asp Asp Leu Trp Ile Ser Ile  
 35 40 45  
 Ser Gly Asp Val Tyr Asp Val Thr Pro Trp Leu Arg His His Pro Gly  
 50 55 60  
 Gly Glu Val Pro Leu Ile Thr Leu Ala Gly Gln Asp Ala Thr Asp Ala  
 65 70 75 80  
 Phe Met Ala Tyr His Pro Pro Ser Val Arg Pro Leu Leu Arg Arg Phe  
 85 90 95  
 Phe Val Gly Arg Leu Thr Asp Tyr Thr Val Pro Pro Ala Ser Ala Asp  
 100 105 110  
 Phe Arg Arg Leu Leu Ala Gln Leu Ser Ser Ala Gly Leu Phe Glu Arg  
 115 120 125  
 Val Gly His Thr Pro Lys Phe Leu Leu Val Ala Met Ser Val Leu Phe  
 130 135 140  
 Cys Ile Ala Leu Tyr Cys Val Leu Ala Cys Ser Ser Thr Gly Ala His  
 145 150 155 160  
 Met Phe Ala Gly Gly Leu Ile Gly Phe Ile Trp Ile Gln Ser Gly Trp  
 165 170 175

Ile Gly His Asp Ser Gly His His Gln Ile Thr Arg His Pro Ala Leu  
 180 185 190  
 Asn Arg Leu Leu Gln Val Val Ser Gly Asn Cys Leu Thr Gly Leu Gly  
 195 200 205  
 Ile Ala Trp Trp Lys Phe Asn His Asn Thr His His Ile Ser Cys Asn  
 210 215 220  
 Ser Leu Asp His Asp Pro Asp Leu Gln His Leu Pro Leu Phe Ala Val  
 225 230 235 240  
 Ser Thr Lys Leu Phe Asn Asn Leu Trp Ser Val Cys Tyr Glu Arg Thr  
 245 250 255  
 Leu Ala Phe Asp Ala Ile Ser Lys Phe Phe Val Ser Tyr Gln His Trp  
 260 265 270  
 Thr Phe Tyr Pro Val Met Gly Phe Ala Arg Ile Asn Leu Leu Val Gln  
 275 280 285  
 Ser Ile Val Phe Leu Ile Thr Gln Lys Lys Val Arg Gln Arg Trp Leu  
 290 295 300  
 Glu Ile Ala Gly Val Ala Ala Phe Trp Val Trp Tyr Pro Leu Leu Val  
 305 310 315 320  
 Ser Cys Leu Pro Asn Trp Trp Glu Arg Val Ala Phe Val Leu Ala Ser  
 325 330 335  
 Phe Val Ile Thr Gly Ile Gln His Val Gln Phe Cys Leu Asn His Phe  
 340 345 350  
 Ser Ser Ala Val Tyr Val Gly Pro Pro Lys Gly Asn Asp Trp Phe Glu  
 355 360 365  
 Arg Gln Thr Ala Gly Thr Leu Asp Ile Lys Cys Ser Pro Trp Met Asp  
 370 375 380  
 Trp Phe His Gly Gly Leu Gln Phe Gln Val Glu His His Leu Phe Pro  
 385 390 395 400  
 Arg Leu Pro Arg Cys His Tyr Arg Met Val Ala Pro Ile Val Arg Asp  
 405 410 415  
 Leu Cys Lys Lys His Gly Leu Ser Tyr Gly Ala Ala Thr Phe Trp Glu  
 420 425 430  
 Ala Asn Val Met Thr Trp Lys Thr Leu Arg Ala Ala Ala Leu Gln Ala  
 435 440 445  
 Arg Glu Ala Thr Thr Gly Ala Ala Pro Lys Asn Leu Val Trp Glu Ala  
 450 455 460  
 Leu Asn Thr His Gly  
 465

<210> 13  
 <211> 458

<212> PRT

<213> Helianthus annuus

<400> 13

Met Val Ser Pro Ser Ile Glu Val Leu Asn Ser Ile Ala Asp Gly Lys  
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Lys Tyr Ile Thr Ser Lys Glu Leu Lys Lys His Asn Asn Pro Asn Asp  
20 25 30  
Leu Trp Ile Ser Ile Leu Gly Lys Val Tyr Asn Val Thr Glu Trp Ala  
35 40 45  
Lys Glu His Pro Gly Gly Asp Ala Pro Leu Ile Asn Leu Ala Gly Gln  
50 55 60  
Asp Val Thr Asp Ala Phe Ile Ala Phe His Pro Gly Thr Ala Trp Lys  
65 70 75 80  
His Leu Asp Lys Leu Phe Thr Gly Tyr His Leu Lys Asp Tyr Gln Val  
85 90 95  
Ser Asp Ile Ser Arg Asp Tyr Arg Lys Leu Ala Ser Glu Phe Ala Lys  
100 105 110  
Ala Gly Met Phe Glu Lys Lys Gly His Gly Val Ile Tyr Ser Leu Cys  
115 120 125  
Phe Val Ser Leu Leu Leu Ser Ala Cys Val Tyr Gly Val Leu Tyr Ser  
130 135 140  
Gly Ser Phe Trp Ile His Met Leu Ser Gly Ala Ile Leu Gly Leu Ala  
145 150 155 160  
Trp Met Gln Ile Ala Tyr Leu Gly His Asp Ala Gly His Tyr Gln Met  
165 170 175  
Met Ala Thr Arg Gly Trp Asn Lys Phe Ala Gly Ile Phe Ile Gly Asn  
180 185 190  
Cys Ile Thr Gly Ile Ser Ile Ala Trp Trp Lys Trp Thr His Asn Ala  
195 200 205  
His His Ile Ala Cys Asn Ser Leu Asp Tyr Asp Pro Asp Leu Gln His  
210 215 220  
Leu Pro Met Leu Ala Val Ser Ser Lys Leu Phe Asn Ser Ile Thr Ser  
225 230 235 240  
Val Phe Tyr Gly Arg Gln Leu Thr Phe Asp Pro Leu Ala Arg Phe Phe  
245 250 255  
Val Ser Tyr Gln His Tyr Leu Tyr Tyr Pro Ile Met Cys Val Ala Arg  
260 265 270  
Val Asn Leu Tyr Leu Gln Thr Ile Leu Leu Leu Ile Ser Lys Arg Lys  
275 280 285  
Ile Pro Asp Arg Gly Leu Asn Ile Leu Gly Thr Leu Ile Phe Trp Thr  
290 295 300



Trp Phe Pro Leu Leu Val Ser Arg Leu Pro Asn Trp Pro Glu Arg Val  
 305 310 315 320  
 Ala Phe Val Leu Val Ser Phe Cys Val Thr Gly Ile Gln His Ile Gln  
 325 330 335  
 Phe Thr Leu Asn His Phe Ser Gly Asp Val Tyr Val Gly Pro Pro Lys  
 340 345 350  
 Gly Asp Asn Trp Phe Glu Lys Gln Thr Arg Gly Thr Ile Asp Ile Ala  
 355 360 365  
 Cys Ser Ser Trp Met Asp Trp Phe Phe Gly Gly Leu Gln Phe Gln Leu  
 370 375 380  
 Glu His His Leu Phe Pro Arg Leu Pro Arg Cys His Leu Arg Ser Ile  
 385 390 395 400  
 Ser Pro Ile Cys Arg Glu Leu Cys Lys Lys Tyr Asn Leu Pro Tyr Val  
 405 410 415  
 Ser Leu Ser Phe Tyr Asp Ala Asn Val Thr Thr Leu Lys Thr Leu Arg  
 420 425 430  
 Thr Ala Ala Leu Gln Ala Arg Asp Leu Thr Asn Pro Ala Pro Gln Asn  
 435 440 445  
 Leu Ala Trp Glu Ala Phe Asn Thr His Gly  
 450 455

<210> 14  
 <211> 38  
 <212> DNA  
 <213> Artificial Sequence

<220>  
 <223> Definition of Artificial Sequence:PCR primer for 5' of pk0011.d5

<400> 14  
 ttgcgccg caaatcaatg gaagaagcaa agaag 35

<210> 15  
 <211> 33  
 <212> DNA  
 <213> Artificial Sequence

<220>  
 <223> Definition of Sequence: antisense PCR primer for 3' of pk0011.d5

<400> 15  
 ttgcgccg ccaggattca cccgaaagtg ttc 33

<210> 16  
 <211> 823  
 <212> DNA  
 <213> Triticum aestivum

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<222> (769)

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<221> unsure  
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<221> unsure  
<222> (807)

<400> 16  
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cttctctctg agtctctgacc acccctcctc gcgctccagc taaatccacg ccaccgatgg 120  
cccgcacggg cttcgcggaac gcaacggcgc cggaagccga cgcaatgccg gccgccagca 180  
aggacgccgc cgacgtccgc atgatctcca ccaaggagct gcaggcgcac gccgccgcgg 240  
acgacctctg gatctccatc tccggggacg tctacgacgt cacgccctgg ctgcgccacc 300  
accggggcgg cgaggtcccg ctcatcacc tgcgccgcca ggacgccacc gacgccttca 360  
tggcctacca cccgccctcc gtgcgccccg tctctccgccc cttcttcgtc ggccgcctca 420

ccgactacac tgtccccccc gcctccgccg acttccgccg cctcctcgcg cagctctcct 480  
 ccgcgggcct cttcgagcgc gtcggcacac cccaagttc ctgctcgtcg caaagtngt 540  
 gctcttctgc atcggcctct actgctcctc gcctgctcaa caccggggcc acatgttcgc 600  
 cgggggctca ttggcttata tggtcagtcg ggctggattg gcatactccg gcacacaaat 660  
 cacaggcacc tgcctcaacg ctctgnagtg gctcgggaat gctnacggct cggatcncgt 720  
 gggagtnanc acacaanaca nattctgaan ngtcacatac ctgactcana ttccgtntcg 780  
 ggtcacaagt ctaaaacttg catcgtnaag acttggttag cat 823

<210> 17

<211> 114

<212> PRT

<213> Triticum aestivum

<400> 17

Met Pro Ala Ala Ser Lys Asp Ala Ala Asp Val Arg Met Ile Ser Thr  
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Lys Glu Leu Gln Ala His Ala Ala Ala Asp Asp Leu Trp Ile Ser Ile  
 20 25 30

Ser Gly Asp Val Tyr Asp Val Thr Pro Trp Leu Arg His His Pro Gly  
 35 40 45

Gly Glu Val Pro Leu Ile Thr Leu Ala Gly Gln Asp Ala Thr Asp Ala  
 50 55 60

Phe Met Ala Tyr His Pro Pro Ser Val Arg Pro Leu Leu Arg Arg Phe  
 65 70 75 80

Phe Val Gly Arg Leu Thr Asp Tyr Thr Val Pro Pro Ala Ser Ala Asp  
 85 90 95

Phe Arg Arg Leu Leu Ala Gln Leu Ser Ser Ala Gly Leu Phe Glu Arg  
 100 105 110

Val Gly